Meeting Changing Irrigation Demand through Pressurized Distribution

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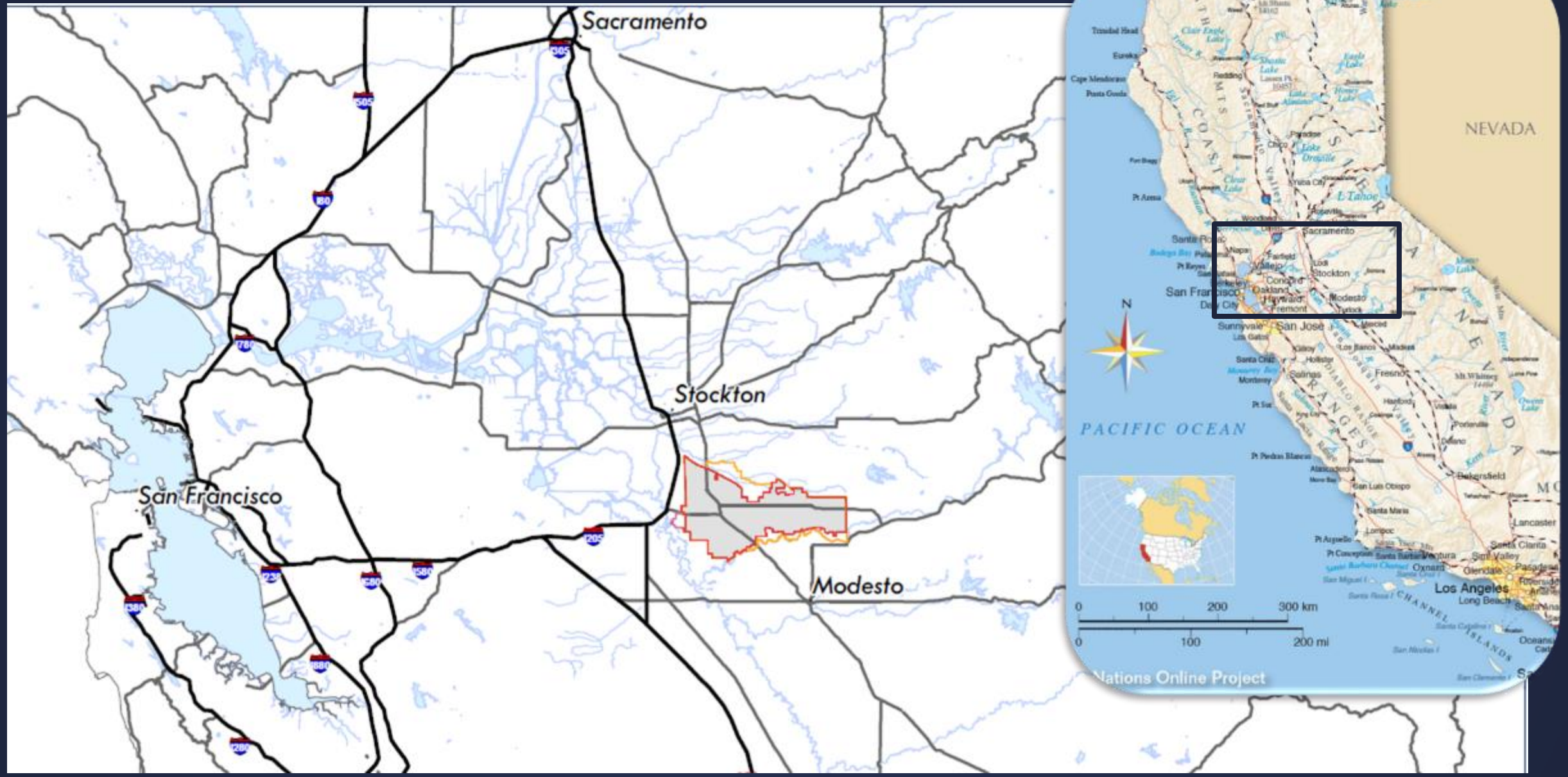
SOUTH SAN JOAQUIN IRRIGATION DISTRICT

About South San Joaquin Irrigation District…

- Irrigation District formed in 1909 and has senior water rights on the Stanislaus River
- Delivery system was designed to deliver water by gravity flow from dams and reservoirs on the Stanislaus River through a network of canals and pipelines to its 72,000 acre service territory.
- 13 miles of supply canal, 18 miles of main distribution canal, 312 miles of distribution pipelines, 38 miles of lined lateral canals, one off-stream reservoir
- Serve approximately 56,000 acres of irrigated agriculture consisting of
  - Permanent Crops (75%)
    - Almonds (64%)
    - Walnuts, stone fruit, and wine grapes (11%)
  - Annual crops (21%)
- Operate a Water Treatment Plant for wholesale deliveries to local cities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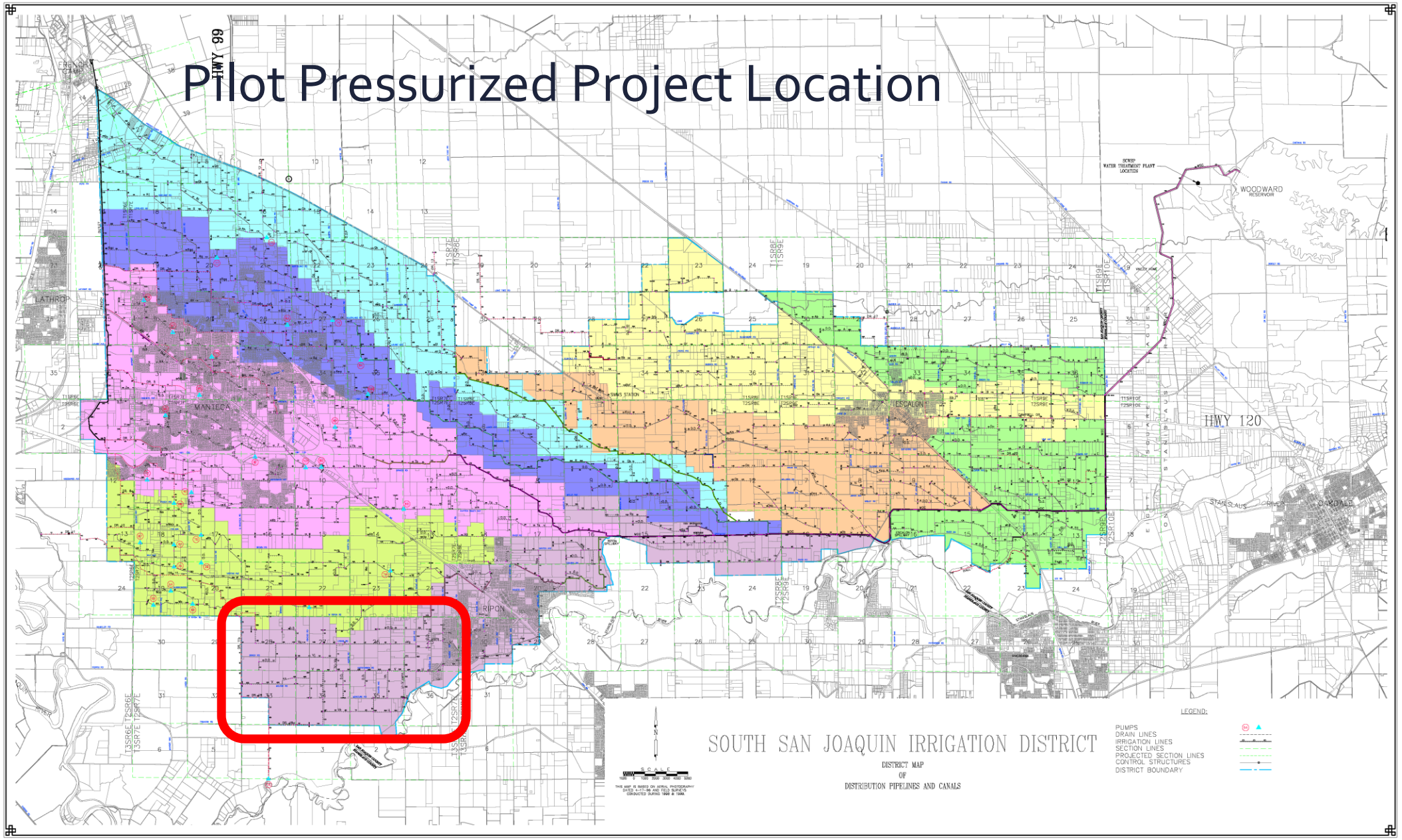
Water Costs and Drought

- For irrigation delivery, gravity distribution reduces operating costs, meaning most irrigation water O&M costs are fixed, however the amount of water delivered during the drought decreased, thereby increasing irrigation cost-of-service.
  - 2012 $72.48 / acre-foot
  - 2013 $79.65 / acre-foot
  - 2015 $90.00 / acre-foot (approx.)
- In 2015 and 2016, the District adopted allocation limits on growers to match available supplies and promote conservation of limited resource to preserve stored water
  - 2014 No allocation limit
  - 2015 36-inch vertical limit
  - 2016 40-inch vertical limit
  - In each year, equivalent reduction in treated water allocations to Cities

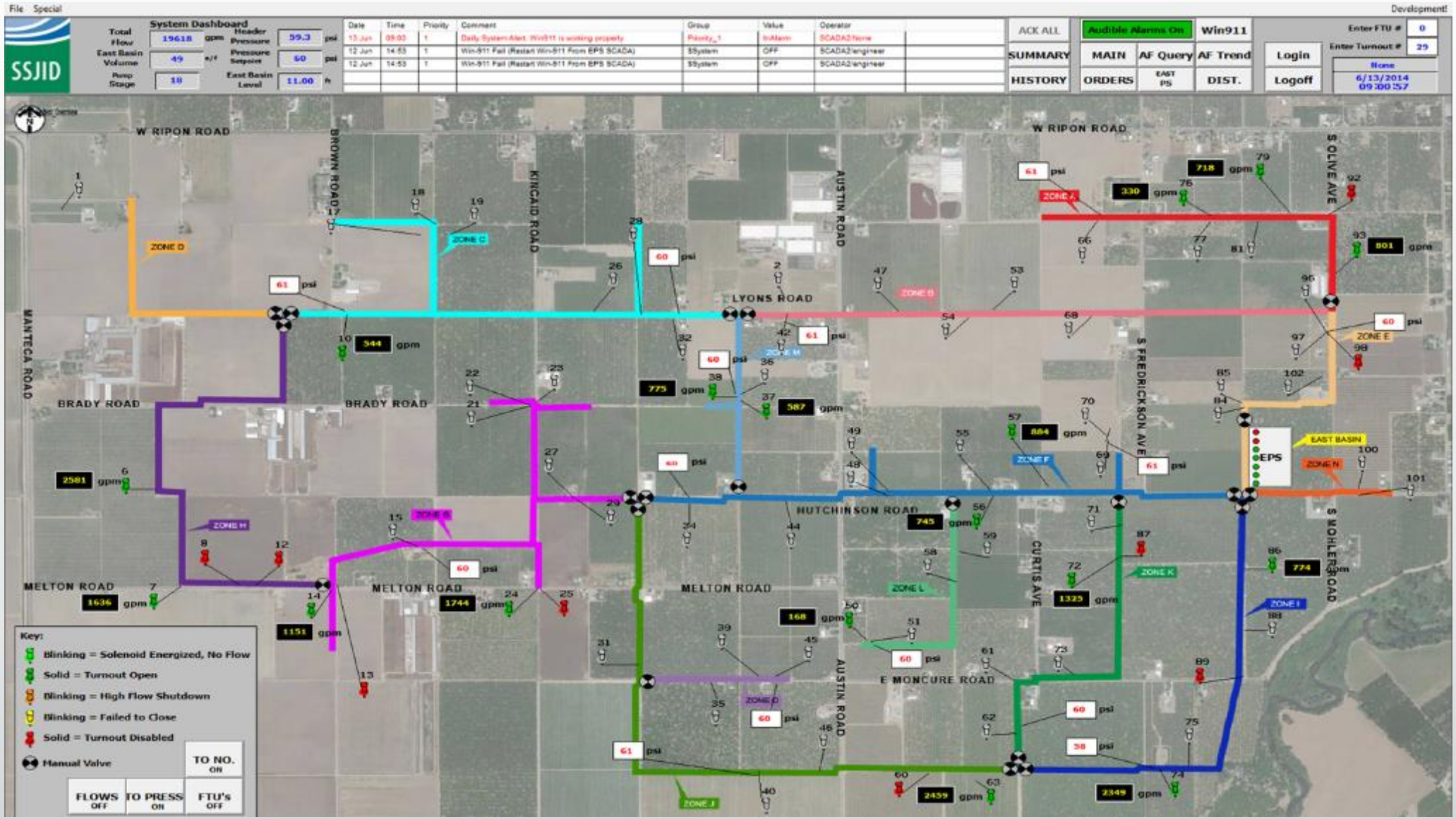
Background

- Water delivery is accomplished through a rotational schedule where growers are notified of availability of water every 10 days
- The system was designed for flood irrigation which resulted in operational spills and tail water drainage.
- Increasing number of growers who have decided to convert to more water efficient systems such as drip and sprinkler irrigation and want more flexibility in delivery schedules to optimize crop water management, reduce irrigation water use
- District decided to construct a "proof-of-concept" pilot pressurized irrigation project to improve irrigation delivery flexibility and conservation

Pilot Pressurized Project Location



Project Map- 3,800 acres (1,540 hectares)



East Basin Pump Station

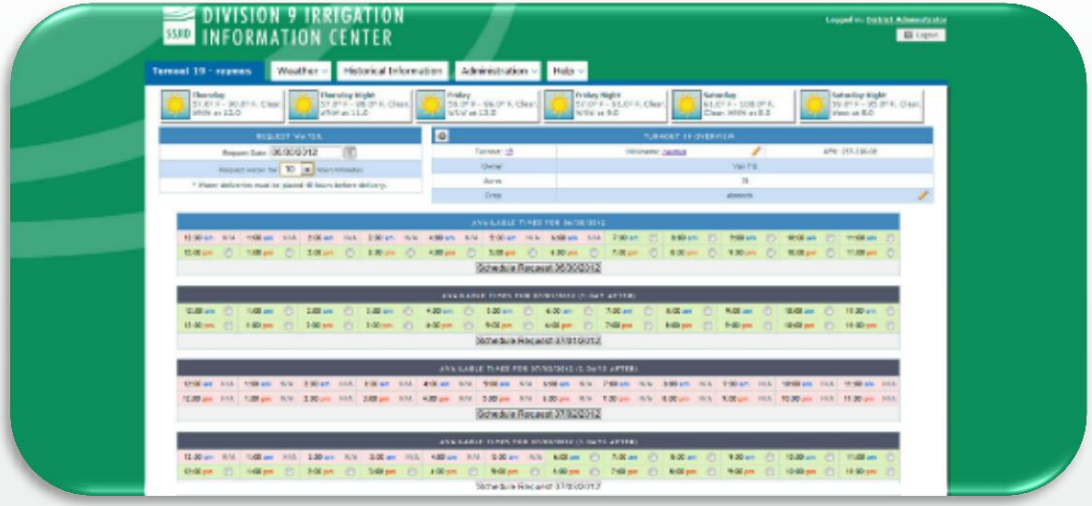
- Vertical Turbine Pumps (VFDs)
  - 4-5,000 GPM
  - 1-2,500 GPM
  - 2-1,000 GPM (alternating)
  - 7 pumps total at 23,500 GPM or 52 CFS (1,225 total HP)
- Provides 55 PSI of pressure to each customer
- 58 acre-foot reservoir
- Control room with SCADA equipment and servers for automation and customer scheduling

Customer Turnouts

Field Telemetry Units

Innovative Features

- Web-based Customer Portal
- Weather and moisture sensor data to make irrigation scheduling decisions
- Airline-ticket style ordering
- Email and text notifications to confirm irrigation events
- Control algorithms to prevent water loss due to catastrophic failure



Key Benefits of Pressurized System

- Provided customer with a flexible irrigation schedule
- Reduced operational spills and efficient water usage resulted in 12,500 AF of water savings per year
- Reduced groundwater pumping through in-lieu recharge
- Improved yields (Pressure customers reported 6,900 lbs / acre for existing orchards and 180 lbs/acre on orchards with second leaf)
- Reduced farm runoff (flood irrigators were able to irrigate quicker)
- Reduced production inputs (better application of chemicals)
- Ability to accurately bill volumetrically (complies with SBX7-7 Magnetic flow meters at each customer connection accurate to 0.5%)
- Reduced overall energy use (eliminated inefficient farmer pumps)
- Improved air quality by eliminating diesel pumping
- Reduced on-farm labor and O&M costs

Construction & O&M Costs

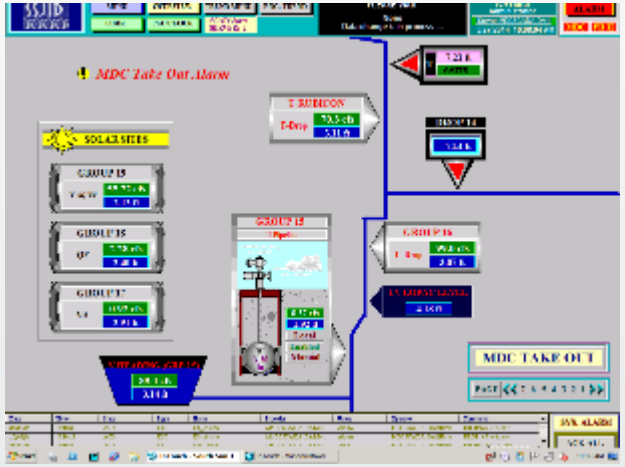
- Construction Costs: $14,000,000 (US)
- Bureau of Reclamation Grant: $1,000,000
- Net District Construction Cost: $13,000,000
- Customer pays $30 per ac. ft. in addition to the base charge (recently increased to $44.00 per acre-foot)

Feasible at the District Scale?

- Completed a study in 2016 aimed to determine the feasibility of upscaling the pressurized irrigation concept to the District level
- Findings:
  - Financial Feasibility – Magnitude of capital costs would exceed customers ability or willingness to pay rates inclusive of capital and O&M costs unless outside funding was generated through water transfers or grant opportunities.
  - Economic Feasibility – on farm benefits did not exceed costs
- Customers love the service and wish to have it throughout the District, however economics preclude the ability of the District to construct the project without outside funding.

Other Conservation Efforts

- Main distribution canal flow measurement and automation
- On-Farm metering program
- Drain monitoring
- Conservation funding program
- Licensed microwave communication system
- Mobile deployment of SCADA and water accounting to distribution operators



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